Managing Extractive Resource Wealth for Sustainability: Alaska in the Time of Falling Oil Production

presented at the
7th International Congress
Arctic Social Sciences (ICASS VII)
Akureyri, Iceland

by

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June 2011

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Cash economies in many parts of the Arctic North have long been dominated by resource extraction industries such as petroleum and metal mining. These developments are often short lived, generating cycles of economic booms followed by busts. And the wealth created by these activities tends to flow South, as profits to large firms and wages to temporary residents. But in Alaska the Permanent Fund (and a number of smaller financial accounts), has captured a significant share of the wealth generated by the production of petroleum over the last 30 years. Alaska residents now have the opportunity to use this wealth (currently estimated at $45 billion in financial assets and $81 billion in the state share of oil still in the ground) to build a strong economy, not only for the current generation but for future generations of Alaskans as well. This will be a unique challenge, balancing the needs of current and future generations, the preferences of urban and rural residents, permanent and temporary citizens, and others. This paper will examine the challenges facing Alaska as it begins the task of wealth management in an era of declining petroleum production. This should provide lessons for other regions impacted by cycles of resource extractive industries.

This study is one in a series of reports in the ISER program

Investing for Alaska's Future

Underwritten by a generous grant from

Northrim Bank

With support from

University of Alaska Foundation

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INTRODUCTION

Alaskans have always been dependent on the rich natural resources of the state for their livelihood and prosperity--from the fur seals and salmon before European contact to the timber, minerals, and petroleum of more recent times. Production has often been at a small cost compared to value. Thus for example, the bountiful salmon provided the basis for the rich Native American culture in the Alaskan panhandle that gave rise to a beautiful artistic heritage. With the arrival of the Europeans, commercial markets for these resources developed, and the with ., and this Exploitation hasone recent projection of employment in currently producing areas shows only a modest decline in employment over the next two decades.

The most well known example of this exploitation was the dominance of the salmon harvest by seattle. Also the mine at mccarthy.

With statehood and public ownership of resources that changed. Now the state has both the power to tax and the ownership. It cannot control labor supply, and this is a politically touchy subject, but the state has the ability now to capture a larger share of the value of the resources produced fpr the benefit of Alaskans. In fact it is in the constitution.

It has not done this in a consistent way. Fish vs petroleum.

And a lot of concern that the stat is not getting its “fair shaire” (the oil companies are all non resident.)

But the state has collected $150 billion in the last 50 years from oil.

The resources of the state are unevenly distributed across the state. Three good examples of local governments capturing a share of the value of production. North Slope Borough using taxation of property. Taxes go for jobs and infrastructure. Northwest Arctic Borough mining development is on native American land of Nana Regional Corporation. Operated by private company paying royalties to Nana and hiring shareholders. CDQs in SW Alaska get a share of the allocation of bottomfish. What do they do with it.

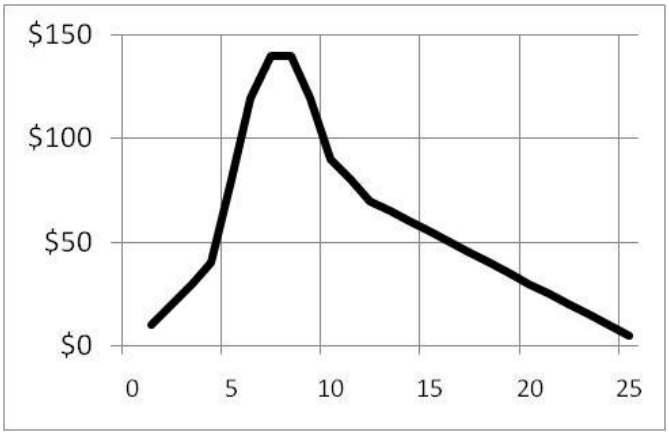
So there are many ways to appropriate a share of the value of the resource—both the jobs and the economic rents. The purpose of this paper is not to discuss methods of appropriation, although they are clearly important,(fair share, jobs vs income, etc.) but rather to look at management of the economic rents collected.

There are other economic development strategies, but what are they?

THE BASIC RULE FOR WEALTH MANAGEMENT

In the typical case, the extraction value of a communally owned non-renewable natural resource deposit will follow the pattern over time shown in Figure 1. In the early years the value of production will be high because the highest value reserves will be produced first. Over time production will move to lower value deposits with higher costs, and eventually production will stop when the cost of production becomes prohibitive.

Figure 1



This production profile creates two potential problems if the resource value is large relative to the size of the regional economy. First, it can create a temporary economic boom from local spending to purchase labor and other inputs to extract the resource. Second, it can create a challenge for the region to distribute any economic benefits associated with extraction of the resource equitably both across the population and over time.

Those local benefits consist of jobs and business opportunities for residents and the profits from the operation shared with the region as taxes, royalties, or other payments. If the regional economy were very small, it might provide neither labor nor business support for the extraction operation in which case it would occur within an “enclave” which would be physically within the region, but not connected to the region economically. In that case the benefits to the region would consist entirely of consumption goods purchased from outside the community paid for with the locally retained profits.

The question then becomes how to manage those profits generated from this non-renewable collectively owned resource. One obvious answer is to spend them as they accrue which would result in a time pattern of spending similar to figure 1. Spending would then be high in the early years and gradually taper off as production declined. This spending could result in a temporary economic boom in employment and business activity within the community that was not sustainable. The timing of other benefits

could also follow the pattern of spending, creating a temporary increase followed by a drop.

However the community might view the windfall from the profits as an opportunity to increase the sustainable level of economic activity and prosperity within the community and so try to manage them for that purpose by saving some of the profits for future use. Two simple savings rules have been suggested to accomplish this—Bird-in-the-Hand and Permanent Income (Sustainable Spending).

The Bird-in-the-Hand rule says to put all current revenues from resource production into a savings account and spend only the earnings generated by that account each year.[1] With this rule spending would begin low and gradually increase over time. When resource production ended all the revenues that it had generated would be in a financial savings account and from that point forward a constant and sustainable flow of annual earnings would be available for the benefit of the community.

This rule is attractive because of its simplicity, ease of implementation, and intuitive appeal. Its shortcomings are that it requires incredible discipline to forego using any current revenues as they are collected, and it gives more weight to future needs relative to immediate ones. It would be better to try to distribute the benefits equitably between current and future needs.

The Permanent Income rule explicitly tries to allocate the benefits from exploitation of the resource over time between the current and future populations. It starts with an estimate of the total value of the non-renewable asset to the community. Before production begins this is the present value of the revenues the community will collect as the resource is produced.[2] As production occurs and revenues are collected, the value of revenues in the ground declines, but this would be offset if the amount added to

[1] This is basically the approach taken by Norway and the approach suggested for Alaska by Roger Cremo which became known as the "Cremo Plan"

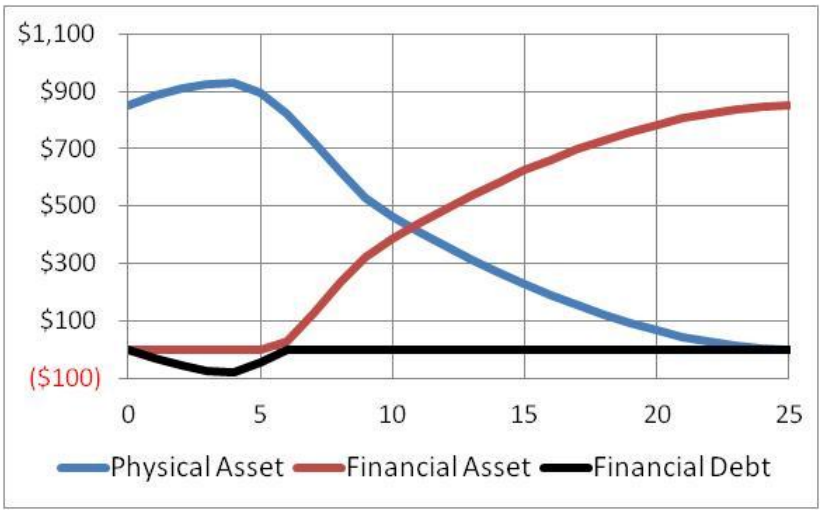
[2] One could also think of it as the market value of the future stream of revenues if they were sold.

savings increased each year by the same amount. The community would then have a portfolio of assets consisting of savings from a share of past revenues and the value of revenues yet to be collected from resources yet to be produced. Over time savings would increase and the value of resources in the ground would fall, and when all the resources had been produced the value of the portfolio would be entirely in savings and be equal to the initial value of the resource in the ground.

The value of the portfolio would be constant over time and spending each year would equal a fixed rate of return on that portfolio. This stream of spending would be constant and sustainable both during the period of resource production and beyond after production had ended. Annual spending would be independent of the composition of the portfolio.

The composition of the portfolio using this Permanent Income rule is shown in Figure 2 which shows that initially the wealth is held entirely as the physical asset (net present value of future revenues). As production proceeds and the revenues are collected, some of them are deposited into a growing savings account. By the time the resource has been exhausted the value of the financial account has grown to exactly replace the initial value of the resource which has fallen to zero. The value of the portfolio remains constant at every point in time. (See appendix for numerical example.)

Figure 2



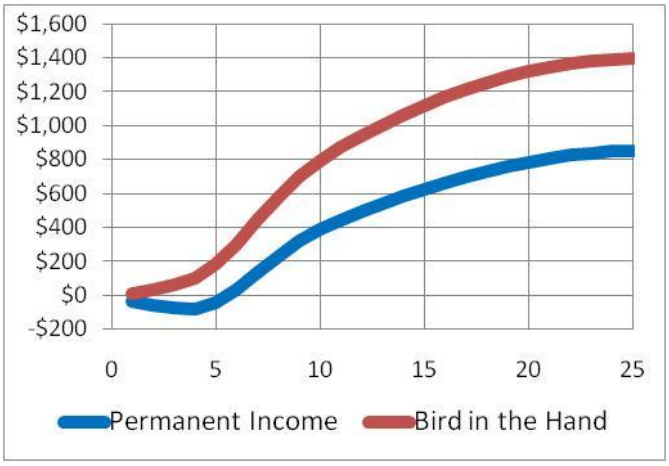
The constant annual level of spending in the early years comes from a share of current revenue not saved, later from a combination of revenues and some savings account earnings, and finally entirely from earnings of the savings account. However in the first couple of years in this example before there is any savings in the portfolio, current revenues are less than the annual earnings of the portfolio. As a result in the first couple of years current revenues are augmented by borrowing in order to have enough cash to fund spending (financial debt in Figure 2). As current revenues rise above the constant spending level, this initial borrowing is repaid and savings begins.

Annual spending using the Permanent Income rule for wealth management is higher in the early years than using the Bird in the Hand rule, but eventually it is less. If the objective is to spread the benefits of the wealth equitably over time, the Permanent Income rule does a better job. It results in the maximum level of annual spending that is sustainable over time.

Figure 3 Annual Spending

The ultimately higher sustainable spending level with the Bird in the Hand rule results because the portfolio of assets is not constant over time but increases in value as shown in Figure 4.

Figure 4

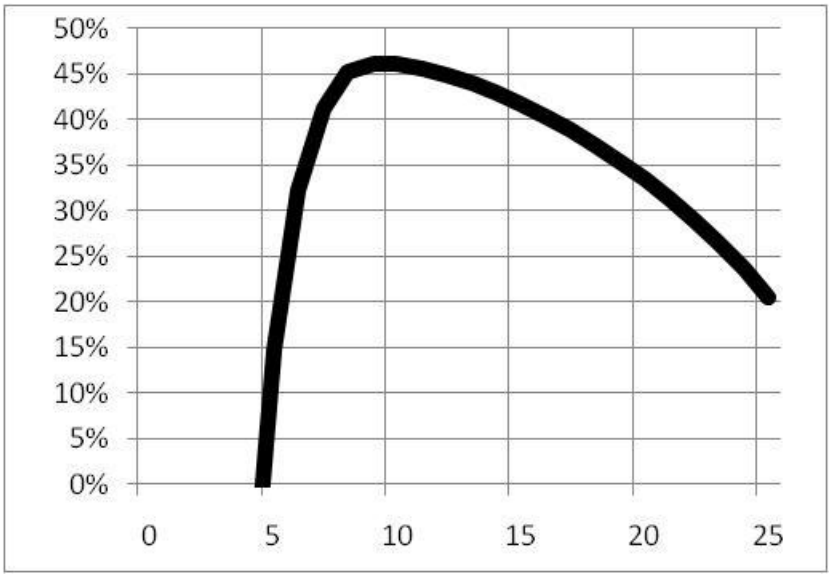


The Permanent Income rule is more difficult to understand and to implement than the Bird in the Hand rule. With the Bird in the Hand rule the savings rate is constant—100%--and spending varies with the size of the savings account. With the Permanent Income rule spending is constant and the savings rate varies from year to year based on the size of current revenue relative to that constant spending amount. There is no simple answer to the question of how much or what percentage should be saved out of current revenues for future needs.[3] As we have seen in the initial years saving is likely to be actually negative.

The Permanent Income rule is thus confusing if the question of wealth management is posed as is often the case as "Are we saving enough?" A savings rate out of current revenues that fluctuates from year to year can be confusing to people asking that question. And the same is true if the cumulative share of revenues saved is used as an indicator of whether savings is adequate. Figure 5 shows that the cumulative share of revenue saved following the Permanent Income rule in this particular case starts at zero, grows rapidly to 45% and ultimately falls off to 20%..This is in marked contrast to 100% as the cumulative share saved using the Bird in the Hand rule.

[3] One of the important questions asked when the Alaska Permanent Fund was proposed was what share of petroleum royalties should be deposited into the fund. The legislature decided on 25%. This was about 10% of total petroleum revenues consisting not only of royalties but also severance, income, and property taxes. Revenues not deposited into the fund have not necessarily been spent, at least not in the year received, but the annual volatility of those revenues does mean that with a constant savings rule there is more volatility in annual spending.

Figure 5 Cumulative Share of Revenue Saved



Is there a compromise between these two rules that produces an ultimate portfolio of savings equal to the Permanent Income rule and is as easy to understand and administer as the Bird in the Hand rule? A modified Bird in the Hand rule where 50% of current revenues were saved and 50% spent would be such a compromise……

But apart from its variable savings rate, the real challenge with use of the Permanent Income rule is the need to estimate the current value of future revenues from the non renewable resource. This requires knowledge of not only the future price profile of the resource but also the cost of production over time and the size of the economically recoverable deposit. All of these in turn are dependent upon technological changes over the life of production. As the wealth is converted from future revenues into financial savings the uncertainty in estimating the value of the portfolio declines but it does not disappear.

This uncertainty can be dealt with in two ways. First, the value of the portfolio can be periodically re-evaluated and revised. Increases would increase the size of the sustainable annual spending amount and vice versa. Second, the size of the

sustainable annual spending amount can be risk adjusted to reflect the uncertainty in the ultimate value of the portfolio. However the direction of any adjustment is not obvious. A downward adjustment is consistent with the idea that the ultimate pain from overestimation is greater than the pain from an equal sized underestimate. On the other hand an upward adjustment is consistent with the idea that forecasts tend to by myopic, particularly with regard to technological change that can enhance the value of resource deposits.

The Permanent Income rule can be readily modified to account for anticipated changes in future conditions. If population is expected to grow, the consumption draw rate can be modified so that it is constant per person.[4] If future needs are expected to be greater than current needs then the current consumption draw rate can be reduced relative to the future.[5]

SOME COMPLICATING FACTORS

The description of the Permanent Income rule has assumed that the savings account consists of investments made outside the community and that the benefits to the community come entirely from the consumption goods purchased from outside the region using the earnings from the wealth portfolio. With these assumptions the application of the Permanent Income rule to the management of natural resource wealth makes the community richer, because its annual sustainable rate of consumption has increased, but the economy, measured by jobs, is no bigger than it was before exploitation of the natural resource.

INVESTMENT SPENDING

[4] For example, if the real return on the portfolio is 5% and the population growth rate is 1%, then an annual consumption draw of 4% would maintain the per capita value of the wealth portfolio by increasing its total value by 1% annually.

[5] Norway reduces the current annual draw from their fund to account for the aging of their population and the expected increase in public benefits that will entail.

Community residents benefit from investment spending as well as current consumption spending. A successful investment produces a stream of benefits that extends for many years into the future. So community benefits are maximized not by a sustainable level of spending, but rather by a sustainable level of benefits flowing from a combination of consumption and capital spending.

Infrastructure investments can be incorporated into the Permanent Income rule by including them as a separate account in an expanded asset portfolio including the value of those investments as well as the savings account, and the revenues yet to be collected on future resource production. Now the maximum sustainable flow is not of spending but rather of benefits. Now we assume the community is able to allocate spending so that each dollar of spending on current consumption generates benefits of at least one dollar and that each dollar of spending on infrastructure generates benefits worth at least as much as putting that dollar into savings—the rate of return on investment.

An infrastructure investment can be financed either by paying cash--drawing down the savings account--or by borrowing. Either way the value of the savings account falls by the transfer of fund to the infrastructure account. The annual consumption draw--based on the portfolio excluding the infrastructure investment account—falls by the same amount that the annual benefit associated with the infrastructure increases. The total annual benefit is unchanged but its composition is different.

Whatever the spending it should be on what returns the highest return per $1 spent. It could be $1 or $2 or more, but not less than $1.

If the purpose of the investment is to generate a financial return rather than consumption benefits, then it only maintains the net worth of the portfolio if its financial return is equal to the financial return on the savings account.[6]

[6] Determining that either operations or capital spending generates benefits equal to their cost is not easy when decisions are made collectively.

RESIDENT JOBS

The provision of services or the construction of infrastructure may require the use of onsite labor.[7] Furthermore residents might prefer to fill those jobs to collect the wages. If residents fill all the demand for onsite labor the community benefits not only from the services paid by the windfall, but also from the increase in income from the wages.

This introduces a complication for spreading the benefits equitably over time, but only for spending on infrastructure because wages are paid during construction. tions spending since wages follow the time pattern of benefits, but it does for infrastructure spending. is a problem if it creates labor demand from outside the community, but not for spending if the spending is debt financed and paid back over time at a rate consistent with the benefits generated. The amount in the financial account is unchanged.

Also a problem with resource extraction.

For a community new jobs for residents would be a benefit if the jobs were taken by persons currently unemployed.[8] The wage could be used to measure the benefit of such a job provided to an unemployed resident of the community.

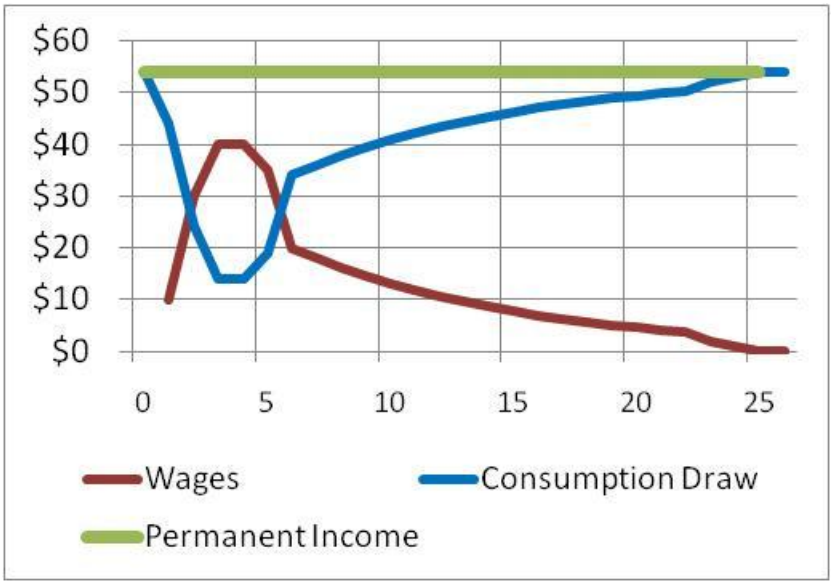
Then the benefits flowing to the community would be both the wealth from rents and taxes and the wages paid to residents. How does this additional source of benefit impact the Permanent Income rule of management?

[7] Non-resident labor can indirectly generate local labor as well if local businesses provide services to those workers..

[8] A new job that diverts a resident away from a job he already can be counted if it puts some other unemployed resident to work.

If community benefit were redefined to include wages as well as the spending from rents and taxes, the Permanent Income rule would need to be modified so that the sum of the two was constant. When employment and wages was high, spending from assets would be low, and vice versa. Total annual benefits would be higher because of the addition of the wage income into the community. The total annual benefit would be based on the net present value of the sum of wages, rents, and tax revenue.

Figure 7



Although total community benefits are sustainable under this expanded Permanent Income rule, if wages are not appropriately distributed among residents, the benefits cannot be equitably distributed among community residents either at any point in time or over time (without complicated sharing or trading which would make the benefits "fungible"). The rent distribution can be somewhat compensating.

If wages paid to residents who would otherwise be unemployed count as benefits to the community in addition to the benefits provided by the services provided by those jobs, then that spending generates more benefit per dollar spent. In this case an expenditure with benefits worth less than $1 could make sense if the wage brought the total over $1. For an operating expenditure, the sum of the two categories would need to be $1. For a

capital expenditure, the sum of the present value of the two categories would need to equal $1. This does not mean that the level of spending would be higher, but rather that the benefit for spending would be greater than $1 because of the local capture of wages. And it might mean that the composition of spending would be different.

In an extreme case, spending could go entirely to wages for currently unemployed residents in some activity with no intrinsic value—like digging holes and filling them in. It is possible these wages would generate as much benefit to the community as spending on some public consumption good provided from outside the community. But it should be possible to find something of positive value for these workers to do for their wages.

With the introduction of wages as a category of benefits, it becomes more difficult to smooth the economic benefits in time and to distribute them equitably across residents in the community because only a few residents get wage income but everyone shares in the public consumption spending. Wage recipients have high benefits when there are jobs, but other residents receive few benefits if public spending is low during that time to compensate. Wage earners do have the ability to save some of their wage income in anticipation of the end of their employment, but recipients of public benefits do not have that option. If some of the public benefits were instead distributed as cash to all residents, then those not benefiting from wages would have more flexibility over time in the distribution of their benefits, but that would not solve the problem of some residents getting more benefits than others because of wage employment.

MIGRATION

Over time residents may leave the community and new people come in to replace them. Outsiders may also be drawn into the community by the employment opportunities associated with the resource exploitation and the provision of services and the construction of infrastructure. These additional workers who become new residents become benefit recipients alongside existing residents and increase the demand for any

scarce resources in the community. Residents who leave the community lose their participation in the community benefits and reduce the demand for scarce resources. [9]

This raise two issues. The first is the need to decide who should be entitled to the benefits flowing from the resource extraction. The most obvious choices are either anyone who lives in the community, or only persons who were residents at some particular time and their decendents. The second is the fact that a change in the size of the resident population impacts the distribution of benefits from resource exploitation.

If anyone who is resident of the community is entitled to the benefits of resource exploitation, management of the wealth portfolio remains simple because the beneficiary population is easy to define. However if only current residents are eligible to receive benefits, then they need to be delivered not as a steady stream over time, but rather as quickly as possible. This will maximize the share going to current residents, but at the cost of receiving them all at once.

The way around that problem would be to distribute the wealth as cash to current residents as a windfall. In theory they would distribute the benefits of that windfall over time rather than spending them all at once. This approach is clearly one of "people prosperity". The wealth is not tied to the community, but rather to the residents at one point in time. With the distribution of wealth to the residents, they are free to live in the community or anywhere else. The additional personal wealth could either be an incentive to stay in the community or to leave. If residents stayed, some of that wealth could be used to support community needs.

If the population increases there should be economies of scale in the provision of goods and services which should be a benefit to all. But it will also increase the demand for scarce resources—like good fishing sites and real estate. This will benefit the owners of

[9] A complicating factor of course is that when a job is created in a community it is not known whether it will be taken by an unemployed resident or a new immigrant.

those resources but disadvantage their consumers. Each resident may weight these benefits and costs of growth differently.rrent residents.

SCALE

If the resource wealth is small relative to the size of the community it would be easy to manage because its effects would be small, but effects would be alale—how does that play in

Before and after—before nothing. During a boom. After dependent on financial earnings. Is that bad? What are you comparing the after environment to.

OPERATIONALIZING THE RULE: THE STATE OF ALASKA

The state received an enormous windfall when oil was discovered at Prudhoe Bay on the North Slope on state land. Since 1977 production has been about 16 billion barrels with a market value of more than $500 billion (2010 $). The state has collected xxx in revenues (2010 $). These revenues have allowed the state to eliminate taxes on households, hold taxes on other natural resource production low, and expand public expenditures to double the per capita average of other states.

Oil revenues xxx. Wages xxxx. Capital spend xxx. A big part of the economy.

Constitution says the wealth should be managed for the benefit of all Alaskans. So it is the owner state….

The state recognized the need to save a portion of the windfall as it was received for three reasons—keep the money out of the hands of the politicians, keep the economy from overheating, and to save for the post petroleum future.

Management of the windfall has involved putting about 23% into saving in three financial accounts—the Permnent Fund, the Constitutional Budget Reserve, and the Statutory Budget Reserve. The objective of the Permanent Fund is to save a share of oil revenues in recognition of the fact the resource is not renewable. The obljective of the Constitutional Budget Reserve is to provide a buffer against the year to year fluctuations in the oil revenues. The objective of the Statutory Budget Resrve is xxxxxx.

A spending cap was also put into place when the SBR was created, but it was too high.. The
Each of these savings accounts was created at a time of current revenue surplus.

The remainder of revenues, 77% or xxx has been spent on current operations, invested in capital goods like schools, roads, energy, or used to capitalize various funds providing loans (or operating revenues (poer cost equalization).

Two policies have been established to control the growth in spending. The first was the spending cap. The second is through restriction of access to the CBR. In addition there is an informal check on the use of the earnings of the Permanent Fune (aside from the Dividend itself.)

Rocky road with ups and downs. Booms, population growth, budget growth, saving when surplus available, draw when times were tight. Advisory vote. Saving in early years, Taxes eliminated.

Policies were never based on the Permanent Income rule, but we were lucky.

Now a renewed sense of urgency because pipeline might shut down and ACES.. How to keep production (jobs) and how to maximize revenues.

But no plan.

Who owns the windfall?

The At the start of 2011 the state had $45 billion in these financial accounts. Projected future production of oil on state land, from which the state receives revenues from royalties and 3 taxes, is 4.5 billion barrels.[10] At an average market price of $100 per barrel, this is $450 billion. The net present value of the projected state revenues from that production that would be collected from that production is $xx billion.[11] Production of natural gas or unconventional oil (viscous oil, heavy oil, and shale oil) is not included in these projections. The state does not make projections of future production on federal lands in or adjacent to the state (ANWR, NPRA, and OCS) or potential revenue from that production. But since natural gas and unconventional oil production on state land is at least a decade away and more expensive than current production, the present value of revenues from that production is small. The same is true for production on federal land.

If we include an estimate of the present value of revenues from gas, unconventional oil, and production on federal lands of xx to the revenues from conventional production on state lands, the total present value of petroleum revenues still to be collected becomes $81 billion. Together with the current financial assets derived from past production, the state has total petroleum wealth of $126 billion.

When Alaskans say “it is our oil”, this is what they mean in terms of what it is worth.

Where are we today wrt non financial assets. Does it matter.No since they ae throwing off benefits.. Yes, because they show that we have actually saved more—AHFC, AIDEA, AEA, other capitalizations. What about schools and harbors. How do they fit into the picture.

[10] Alaska Department of Revenues, Revenue Sources, Fall 2009.

[11] Alaska Department of Revenue, Revenue Source Spring 2011.

The Permanent Income rule or Maximum Sustainable Yield or Preserving the Nest Egg, or Never Spend Principle, or Managing the Windfall, or Managing the Portfolio of Petroleum Wealth…….

As it turns out we have saved almost exactly the amount that has maintained the per capita value of our nest egg based on actual petroleum revenues to date, and currently estimated future petroleum revenues. In other words if we had known in 1977 what revenues would have been through this year and future revenue projections prove accurate the amount we have saved in financial accounts is right on target to keep us on the patch to sustaining our original windfall. If we follow the Permanent Income rule until petroleum production ceases, the size of our financial accounts will be just as big as the original windfall.

So at this point in time we are NOT overextended…….Yippee

Spending of rents in early years does increase the wealth of the population –private development, so the assumption of constant wealth over time may be wrong.

But this has happy result is due as much to good fortune as to good planning. The estimated size of the windfall in 1977 was much less than xxxx both because production and price were projected to be lower than they have been since 1977. Our actual level of spending was too high for the windfall calculated based on 1977 expectations. It has only been because of the higher production and price that our windfall is now consistent with the size of our annual spending.

But the current fiscal policy of the state does not reflect an explicit recognition of the finite nature of petroleum revenues or that the state has a one time windfall. It is to try to save in good years and draw on savings in bad years. This is not a rational policy because both conventional production on state lands and the revenues from that production are projected to fall with a FISCAL GAP between spending and revenues opening in future years. This GAP could be filled using available surpluses for a few

years, but eventually those would be exhausted and a drastic combination of budget cuts and tax increases would be necessary to balance the budget. The economy of the state, so dependent on state spending, would be decimated.

The state could adopt the Permanent Income rule for spending of petroleum wealth. The state could then spend $5 billion in 2011 from petroleum wealth—current petroleum revenues and/or earnings from financial assets. The spending rule could easily be adjusted to account for changes in the return on investment, population growth, estimated future petroleum revenues, myopia, etc. In reality the rule would be a general guide for fiscal policy.

The beauty of this rule is that all generations of Alaskans share equally in the benefits from spending from the petroleum wealth. Total public spending can be greater than this amount, but other revenue sources, such as an income tax, would need to be used to generate that additional revenue. The generation desiring the higher level of spending, and benefiting from it, would be the ones to pay for it. Otherwise the current generation would be benefiting at the expense of a future generation.

The Permanent Income rule is easy to describe and relatively easy to calculate, but it would be extremely difficult to implement in Alaska for a number of reasons.

Here is how it might work.

Not concerned with mix of spend between operations and capital (or distribution). Assume we can accurately measure the benefits from spending (services, jobs, revenues net costs). Since currently there is no state income tax, there is no political test of the value of public spending—either operations or capital. However if the Permanent Income rule were adopted, spending above the amount indicated by the rule would have to come from a tax of some sort like the income tax. If that were to happen, then there would be a political test of the benefits associated with any spending. Or the PFD could provide that test as well.

A tax not only generates income directly. It also reduces spending thru the discipline it instills.

The benefit from an investment should be treated just as a benefit from spending out of annual earnings since it is really the same thing. For example, give a subsidy each year for high energy price. Or invest in some project that lowers energy costs. We would just need to keep track of these investments and segregate them from the main account. The earnings of the main account would fall and the annual draw, but the benefits from the investment would just offset that drop in the annual draw.

What are the implications of spending faster than the sustainable rate? Advantage of continued resource exploitation but not resource rents. It doesn't take anyone to generate the rents, but it does take a lot of workers to continue the resource exploitation—at very high wage rates

So why is it likely?

Reasons why it is difficult to implement the Permanent Income rule (The majority agree it would be a good thing, but cannot implement it):

Now there is a big pile of money.

- Lack of understanding of the structure and mechanism—this comes from population turnover and passage of time.
- Uncertainty about size of asset, rate of return, population growth, future wealth, risk aversion
- Spending currently thru the dividend—how does this constrain flexibility

- Political reality Legislature and governor never vote for a tax increase. Easier to increase the budget than to cut the budget. Always current needs that are obvious compared to unknown future needs.
- Individuals have positive discount rates. This requires a zero discount rate. Maintaining discipline requires completely community decisionmaking. Each person can simultaneously desire to pass as much on to next generation as he takes, but at the same time want to maximize his share of the present distribution of earnings.
- Fragility of social contract—idea that we might exercise constraint, but some future generation will not.
- Speculative migrants who come only to capture a share of the rents and then leave when they are gone.
- How can current generation capture the rents –spend current rents and borrow against future rents so that future residents pay the bill.

Reasons why we might not want to implement the Permanent Income rule

- Aversion to public sector savings (savings is the state tax base)
- Individuals do not feel commitment to future and feel the wealth belongs to them Personal discount rates high—no heirs, plans to leave, other

Fear of the negative consequences of the rentier society (but we already are a rentier society) Usually the fear is that a rentier society will not be able to create a civil society or democratization. Also a bloated bureaucracy where citizenship becomea an asset. There is concern for maintaining a bureaucracy for its own sake, but for Alaska the danger here is that of the trust fund baby syndrome.

- Self selection of optimists who think savings is not necessary since there are many opportunities for growth (Winners curse)
- We have heard this gloom and doom story in the past, but have always been lucky. We will continue to be lucky—high prices and high production, gasline, etc.
- Feeling that life was better in Alaska before petroleum and all the people it brought to the state

- Capital availability is constrained so not a free market situation
- Money in the bank or other financial assets are not working for Alaska, they are helping some other economy
- Future generations may have very different preferences

Desire to continue growth of economy and jobs and spending is the way to accomplish this. Coalition of business, l;arge established local property owners, get rich-quick migrants and other genuinely convince of the growth potential of the hinterland therefor tends to obby for the granspformation of natrurl rent into physical intrastrucutre

Reasons why we should not adopt the Permanent Income Rule

Spend more early on if the benefits from spending when poor are particularly high. Take from the financial account.

Limited capital because projects are too big.

Spend more early on because private wealth increasing during the exploitation stage.

Those reasons are in the past.

Combination of benefits

Private vs public spending.

Really no distinction between spend and invest.

Consider three types of investments—one that generates benefits for residents, one that generates income for the state, and one that generates economic activity -- jobs

and business opportunities for residents. Remember that the investment also requires maintenance costs in future years.

An investment that generates a benefit is a direct substitute for operations spending that generates a benefit. So if investment higher, then operations needs to be lower to maintain the Permanent Income rule.

An investment that generates a financial return—like investing in an economically viable pipeline--should be evaluated against financial investments. Without some other benefits, the gain from investing in a project within the state is just offset by the loss from withdrawing that capital from an alternate investment outside the state.

Spending that generates economic activity is more difficult to assess, and most spending, either on operations or infrastructure, does generate economic activity. .— jobs and business sales--needs to be valued based on the value of those jobs and other economic activity. Use wages, but are they going to residents or new comers. What is the value of the other economic activity.

The typical invesetment or spending may produce a combination of benefits, revenues, and jobs. The problem is that if all revenues come from the wealth account, the growth in population and demand for public services associated with investments to

Can this type of investment be beneficial.

Clear winners would occur without public investment.

Good example is spending on a road to access an oil field. The current cost is too high, including the current tax bill. So the purchase of the road reduces the cost and is like a reduction in taxes—although there are no taxes. If the oil field is developed it generates jobs and revenues. Is this an investment that can pay off.

Try to keep as close to the rule as possible.

Discipline—how to get to get it. Ombudsman or independent group to screen infrastructure projects and public spending.

How to simulate a crisis?

Wait for a real crisis.

Behind this is the uncertainty of development and jobs and business activity associated with federal petroleum reserves.

NORTH SLOPE BOROUGH

Rents and taxes. Distribute benefits through govt spending on capital and public services. What is happening to the population. Local tax base sustainable as long as oil and gas production. What about permanent Fund. Not very big compared to expected wealth. Initially spent a lot to bring quality of life up. Now budget tighter. View fund as an alternative tax base.

Did these two regions lose the most population , just because they were the richest? Did they change the most due to the windfalls.

AND NANA CORPORATION

Distribute benefits throughJobs and payroll

Half resident workers live outside region.

What comes after the mine……..Investing outside the rgion for resident workers.

Here the rents and wages are closely tied together so sustainability more difficult.

What knid of spending is least likely to stimulate inmigration.—does this mean the pi rule should be modified to shift it towards the bith rule. Or does it depend on what the earings are spent on.

Will spending stimulate out migration (does not seem to be the case for Alaska, but it is for places where employment opportunities are limited.)

Is this wehre people ves place prosperity comes in. Start with people prosperity amd temper it with some place prosperity.???

d for consumption purchased outside the economy, there could be no adverse effects. If it is spent on locally produced goods and services in a situation where there is no excess supply of labor, then there would be an increase in

GENERAL GUIDELINES

Put some into place prosperity and some into people prosperity.

How small and how isolated what comes after the mine—half the workers live elsewhere—opportunitey to migrate

Resource ownership

Use of proceeds and flexability

APPENDIX

	Bird-in-the-Hand		
Yr	Revenue	Financial Asset	Annual Draw
0			
1	$ 10	$ 10	$ 0.50
2	$ 20	$ 30	$ 1.50
3	$ 30	$ 60	$ 3.00
4	$ 40	$ 100	$ 5.00
5	$ 80	$ 180	$ 9.00
6	$ 120	$ 300	$ 15.00
7	$ 140	$ 440	$ 22.00
8	$ 140	$ 580	$ 29.00
9	$ 120	$ 700	$ 35.00
10	$ 90	$ 790	$ 39.50
11	$ 80	$ 870	$ 43.50
12	$ 70	$ 940	$ 47.00
13	$ 65	$ 1,005	$ 50.25
14	$ 60	$ 1,065	$ 53.25
15	$ 55	$ 1,120	$ 56.00
16	$ 50	$ 1,170	$ 58.50
17	$ 45	$ 1,215	$ 60.75
18	$ 40	$ 1,255	$ 62.75
19	$ 35	$ 1,290	$ 64.50
20	$ 30	$ 1,320	$ 66.00
21	$ 25	$ 1,345	$ 67.25
22	$ 20	$ 1,365	$ 68.25
23	$ 15	$ 1,380	$ 69.00
24	$ 10	$ 1,390	$ 69.50
25	$ 5	$ 1,395	$ 69.75
26	$ -	$ 1,395	$ 69.75

			Permanent Income / Sustained Yield				
Yr	Revenue (A)	NPV Physical Asset (B)	Annual Draw (C)	Saved Revenue (A-C) (D)	Financial Fund Balance (E)	Sum of Assets (B+E) (F)	Saving Ratio (D/A) (G)
0		**$852.1**				$852.1	
1	$ 10	**$884.8**	$42.61	($32.6)	($32.6)	$852	-326%
2	$ 20	**$909.0**	$42.61	($22.6)	($56.8)	$852	-113%
3	$ 30	**$924.4**	$42.61	($12.6)	($72.3)	$852	-42%
4	$ 40	**$930.7**	$42.61	($2.6)	($78.5)	$852	-7%
5	$ 80	**$897.2**	$42.61	$37.4	($45.0)	$852	47%
6	$ 120	**$822.1**	$42.61	$77.4	$30.1	$852	64%
7	$ 140	**$723.2**	$42.61	$97.4	$129.0	$852	70%
8	$ 140	**$619.3**	$42.61	$97.4	$232.8	$852	70%
9	$ 120	**$530.3**	$42.61	$77.4	$321.9	$852	64%
10	$ 90	**$466.8**	$42.61	$47.4	$385.3	$852	53%
11	$ 80	**$410.1**	$42.61	$37.4	$442.0	$852	47%
12	$ 70	**$360.6**	$42.61	$27.4	$491.5	$852	39%
13	$ 65	**$313.7**	$42.61	$22.4	$538.5	$852	34%
14	$ 60	**$269.4**	$42.61	$17.4	$582.8	$852	29%
15	$ 55	**$227.8**	$42.61	$12.4	$624.3	$852	23%
16	$ 50	**$189.2**	$42.61	$7.4	$662.9	$852	15%
17	$ 45	**$153.7**	$42.61	$2.4	$698.5	$852	5%
18	$ 40	**$121.4**	$42.61	($2.6)	$730.8	$852	-7%
19	$ 35	**$92.4**	$42.61	($7.6)	$759.7	$852	-22%
20	$ 30	**$67.1**	$42.61	($12.6)	$785.1	$852	-42%
21	$ 25	**$45.4**	$42.61	($17.6)	$806.7	$852	-70%
22	$ 20	**$27.7**	$42.61	($22.6)	$824.5	$852	-113%
23	$ 15	**$14.1**	$42.61	($27.6)	$838.1	$852	-184%
24	$ 10	**$4.8**	$42.61	($32.6)	$847.4	$852	-326%
25	$ 5	**$0.0**	$42.61	($37.6)	$852.1	$852	-752%
26	$ -	**$0.0**	$42.61	($42.6)	$852.1	$852	#DIV/0!
Sum	$1,395	**$852.1**				$852.1	

			Permanent Income / Sustained Yield wt Infrastructure							
									Infrastructure	
Yr	Revenue	NPV Physical Asset	Annual Draw	Saved Revenue (A-C)	Financial Fund Balance	Sum of Assets (B+E+H)	Saving Ratio (D/A)		Asset	Benefit
	(A)	(B)	(C)	(D)	(E)	(F)	(G)		(H)	(I)
0		**$852.1**				$852.1				
1	$ 10	**$884.8**	$42.61	($32.6)	($32.6)	$852	-326%			
2	$ 20	**$909.0**	$42.61	($22.6)	($156.8)	$852	-113%		$100.0	
3	$ 30	**$924.4**	$37.61	($12.6)	($172.3)	$852	-42%		$100	$5
4	$ 40	**$930.7**	$37.61	($2.6)	($178.5)	$852	-7%		$100	$5
5	$ 80	**$897.2**	$37.61	$37.4	($145.0)	$852	47%		$100	$5
6	$ 120	**$822.1**	$37.61	$77.4	($69.9)	$852	64%		$100	$5
7	$ 140	**$723.2**	$37.61	$97.4	$29.0	$852	70%		$100	$5
8	$ 140	**$619.3**	$37.61	$97.4	$132.8	$852	70%		$100	$5
9	$ 120	**$530.3**	$37.61	$77.4	$221.9	$852	64%		$100	$5
10	$ 90	**$466.8**	$37.61	$47.4	$285.3	$852	53%		$100	$5
11	$ 80	**$410.1**	$37.61	$37.4	$342.0	$852	47%		$100	$5
12	$ 70	**$360.6**	$37.61	$27.4	$391.5	$852	39%		$100	$5
13	$ 65	**$313.7**	$37.61	$22.4	$438.5	$852	34%		$100	$5
14	$ 60	**$269.4**	$37.61	$17.4	$482.8	$852	29%		$100	$5
15	$ 55	**$227.8**	$37.61	$12.4	$524.3	$852	23%		$100	$5
16	$ 50	**$189.2**	$37.61	$7.4	$562.9	$852	15%		$100	$5
17	$ 45	**$153.7**	$37.61	$2.4	$598.5	$852	5%		$100	$5
18	$ 40	**$121.4**	$37.61	($2.6)	$630.8	$852	-7%		$100	$5
19	$ 35	**$92.4**	$37.61	($7.6)	$659.7	$852	-22%		$100	$5
20	$ 30	**$67.1**	$37.61	($12.6)	$685.1	$852	-42%		$100	$5
21	$ 25	**$45.4**	$37.61	($17.6)	$706.7	$852	-70%		$100	$5
22	$ 20	**$27.7**	$37.61	($22.6)	$724.5	$852	-113%		$100	$5
23	$ 15	**$14.1**	$37.61	($27.6)	$738.1	$852	-184%		$100	$5
24	$ 10	**$4.8**	$37.61	($32.6)	$747.4	$852	-326%		$100	$5
25	$ 5	**$0.0**	$37.61	($37.6)	$752.1	$852	-752%		$100	$5
26	$ -	**$0.0**	$37.61	($42.6)	$752.1	$852	#DIV/0!		$100	$5
Sum	$1,395	**$852.1**				$852.1				

case 3			Permanent Income / Sustained Yield wt Wages							
Yr	Revenue	NPV Physical Asset	Annual Draw	Saved Revenue (A-C)	Financial Fund Balance	Sum of Assets (B+E)	Saving Ratio (D/A)		Value Added from Labor	NPV Wages
	(A)	(B)	(C)	(D)	(E)	(F)	(G)			
0		**$852.1**	**$54.08**			$852.1				**$229.4**
1	$ 10	**$884.8**	$44.08	($34.1)	($34.1)	$851	-341%		10	**$230.9**
2	$ 20	**$909.0**	$24.08	($4.1)	($39.9)	$869	-20%		30	**$212.5**
3	$ 30	**$924.4**	$14.08	$15.9	($25.9)	$899	53%		40	**$183.1**
4	$ 40	**$930.7**	$14.08	$25.9	($1.3)	$929	65%		40	**$152.2**
5	$ 80	**$897.2**	$19.08	$60.9	$59.5	$957	76%		35	**$124.9**
6	$ 120	**$822.1**	$34.08	$85.9	$148.4	$970	72%		20	**$111.1**
7	$ 140	**$723.2**	$36.08	$103.9	$259.8	$983	74%		18	**$98.7**
8	$ 140	**$619.3**	$37.88	$102.1	$374.9	$994	73%		16.2	**$87.4**
9	$ 120	**$530.3**	$39.50	$80.5	$474.1	$1,004	67%		14.6	**$77.2**
10	$ 90	**$466.8**	$40.96	$49.0	$546.9	$1,014	54%		13.1	**$67.9**
11	$ 80	**$410.1**	$42.27	$37.7	$612.0	$1,022	47%		11.8	**$59.5**
12	$ 70	**$360.6**	$43.45	$26.5	$669.1	$1,030	38%		10.6	**$51.8**
13	$ 65	**$313.7**	$44.51	$20.5	$723.0	$1,037	32%		9.6	**$44.9**
14	$ 60	**$269.4**	$45.47	$14.5	$773.7	$1,043	24%		8.6	**$38.5**
15	$ 55	**$227.8**	$46.33	$8.7	$821.1	$1,049	16%		7.7	**$32.7**
16	$ 50	**$189.2**	$47.11	$2.9	$865.0	$1,054	6%		7.0	**$27.3**
17	$ 45	**$153.7**	$47.80	($2.8)	$905.5	$1,059	-6%		6.3	**$22.4**
18	$ 40	**$121.4**	$48.43	($8.4)	$942.3	$1,064	-21%		5.6	**$17.9**
19	$ 35	**$92.4**	$49.00	($14.0)	$975.4	$1,068	-40%		5.1	**$13.7**
20	$ 30	**$67.1**	$49.50	($19.5)	$1,004.7	$1,072	-65%		4.6	**$9.8**
21	$ 25	**$45.4**	$49.96	($25.0)	$1,030.0	$1,075	-100%		4.1	**$6.2**
22	$ 20	**$27.7**	$50.37	($30.4)	$1,051.1	$1,079	-152%		3.7	**$2.8**
23	$ 15	**$14.1**	$52.08	($37.1)	$1,066.6	$1,081	-247%		2.0	**$1.0**
24	$ 10	**$4.8**	$53.08	($43.1)	$1,076.8	$1,082	-431%		1.0	**$0.0**
25	$ 5	**$0.0**	$54.08	($49.1)	$1,081.6	$1,082	-982%		0.0	**$0.0**
26	$ -	**$0.0**	$54.08	($54.1)	$1,081.6	$1,082	#DIV/0!		0.0	**$0.0**
Sum	$1,395	**$852.1**				$852.1				**$229.4**

The typical sovereign island economy is small and remote. For example the remote island nations of Nauru, Niue, and Saint Helena have populations in the range of 10 thousand each. Of course not all island nations are small or remote and neither are small or remote economies necessarily islands. However it is useful to think about the economies of small and remote islands because they can help us to understand the economic structure and prospects of larger and less remote places.

Island economies generally lack a comparative advantage in the production of goods or services for export to the rest of the world. This is due to distance from markets and suppliers as well as an absence of economies of scale and specialization, both of which drive up the cost of exporting goods and services. And although the economic theory of comparative advantage tells us that trade among countries can occur even if one has an advantage in the production of all goods and services, that theory can break down if costs in the small and remote economy are too high.

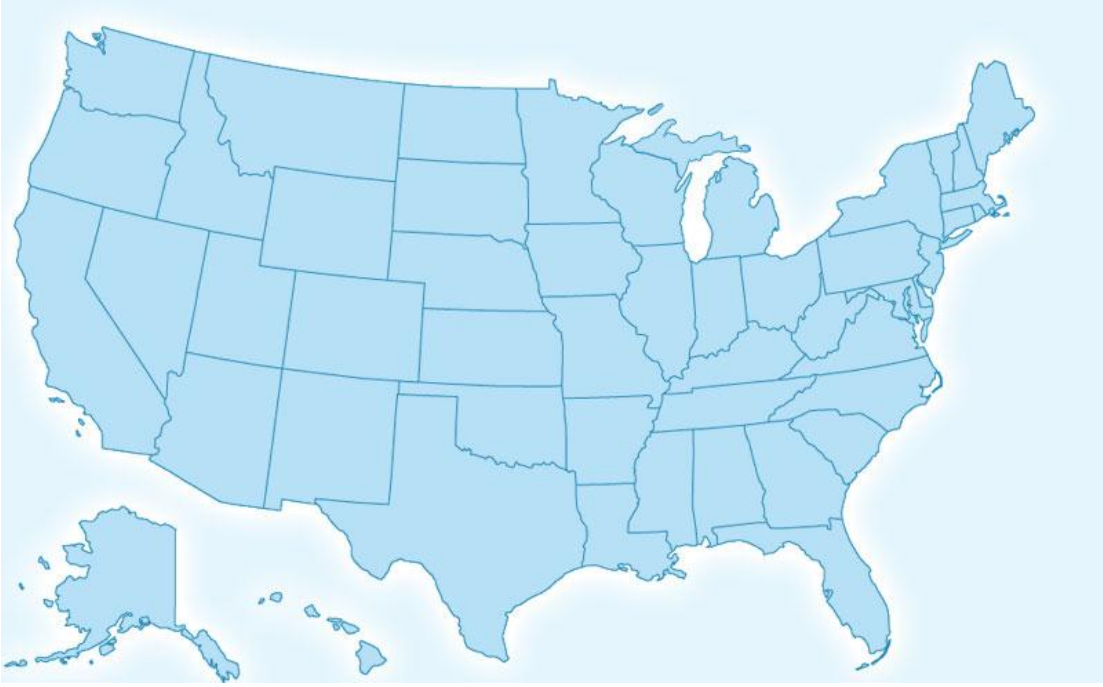
The mechanism by which the island economy gains access to export markets in the presence of high costs is through downward adjustment in the wage. But in some cases the wage would need to become negative to overcome the cost disadvantages created by distance and size. In such a case the island would have a subsistence economy with neither exports to the rest of the world or imports. The most important private economic activities one observes in these economies are agriculture and fishing.

Occasionally an island economy will be able to take advantage of a market niche to generate exports. Tourism is the most common, and mining has provided an export base in some other places. However these market activities will not necessarily be large enough to employ a large share of the population. Furthermore dependence on a single activity leaves these economies vulnerable or “precarious”.

As a consequence many of these economies are dependent on foreign aid and remittances from emigrants. These funds allow these economies to purchase a basic level of imports that would not otherwise be possible.

Based on this description one could almost think of Alaska as an island economy, as it is often presented on maps of the United States.

Figure 1 the Island Alaska



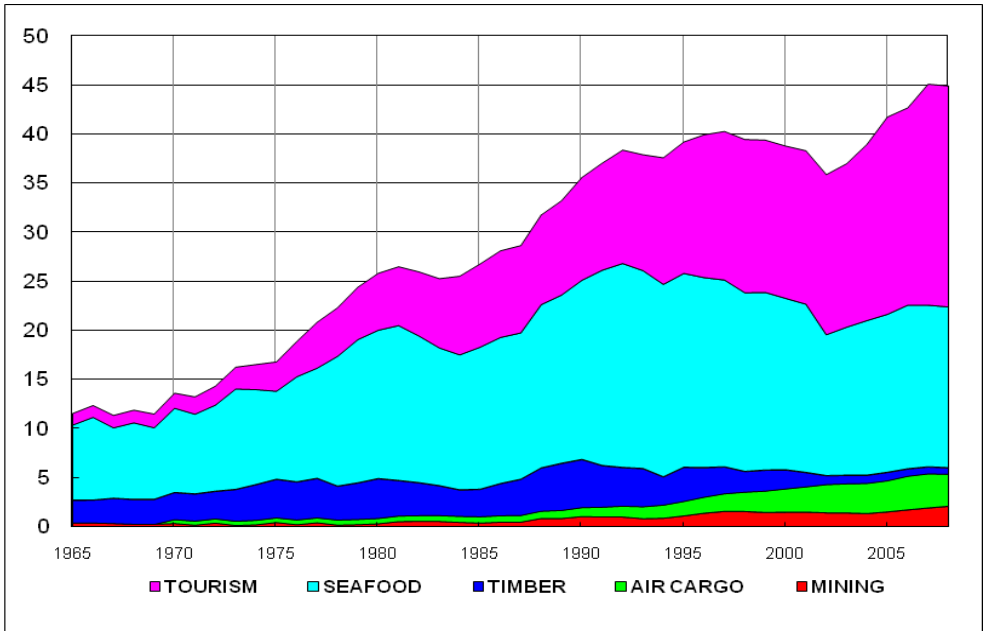
Alaska is certainly remote. The main population center, Anchorage, is a 3 hour plane ride (2,314 kilometers), a 4 day drive, or a week long barge ride from Seattle, the nearest US city of comparable size.

Although it is physically large, the entire population of the state is 710 thousand. Only North Dakota, Vermont, and Wyoming have fewer people.

These characteristics combine to drive up the cost of trade with the rest of the US and world and limit the traditional private sector economic base to a niche market consisting primarily of tourism, fishing, and mining.

In the 50 years that Alaska has been a state those three activities have dominated the private economic base. Figure 2 shows the employment growth associated with these sectors. Tourism has experienced the most growth. Fishing is constrained by the sustainable harvest of the resource. Mining has provided only a small share of jobs. Air cargo is an activity that takes advantage of the location of Anchorage close to the great circle route between the far east and the US west coast. Timber has been in decline.

Figure 2 Employment in Alaska Traditional Private Basic Sectors (000)

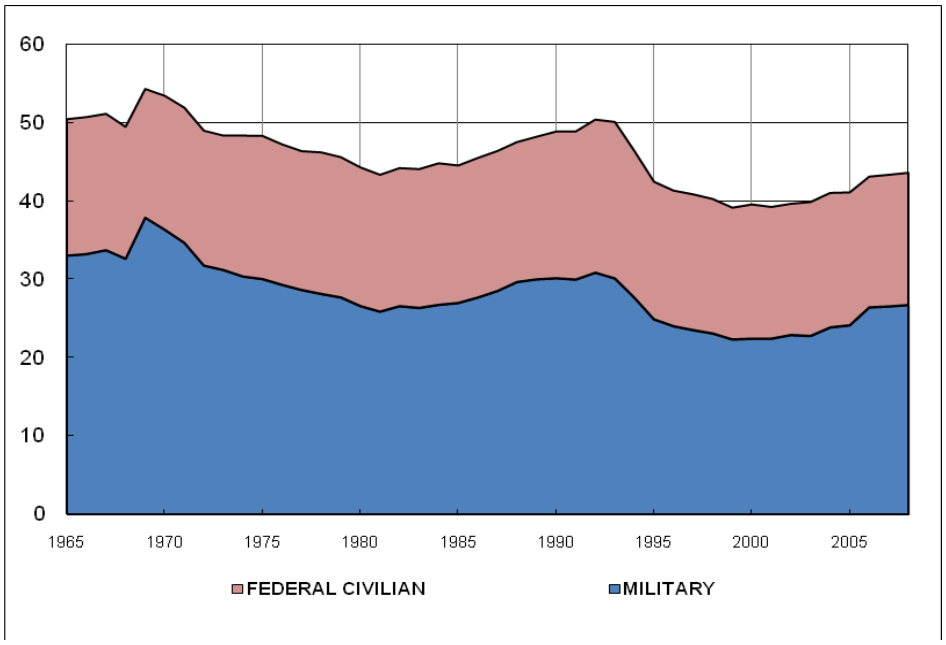


Notably most of the jobs and job growth have been in the two most seasonal industries which employ several times as many workers in the summer as in the winter. This seasonality makes it difficult for a support economy to take root in areas where these sectors dominate.

The state has struggled to develop a more diversified private sector economic base beyond the export of fish and minerals and the provision of services to tourists. Most have concentrated on processing or adding value to the natural resources extracted and exported. High production costs and distance from markets have prevented development of processing except in the seafood industry. Federal policies that restrict access to natural resources are also often suggested as the main impediment to development.

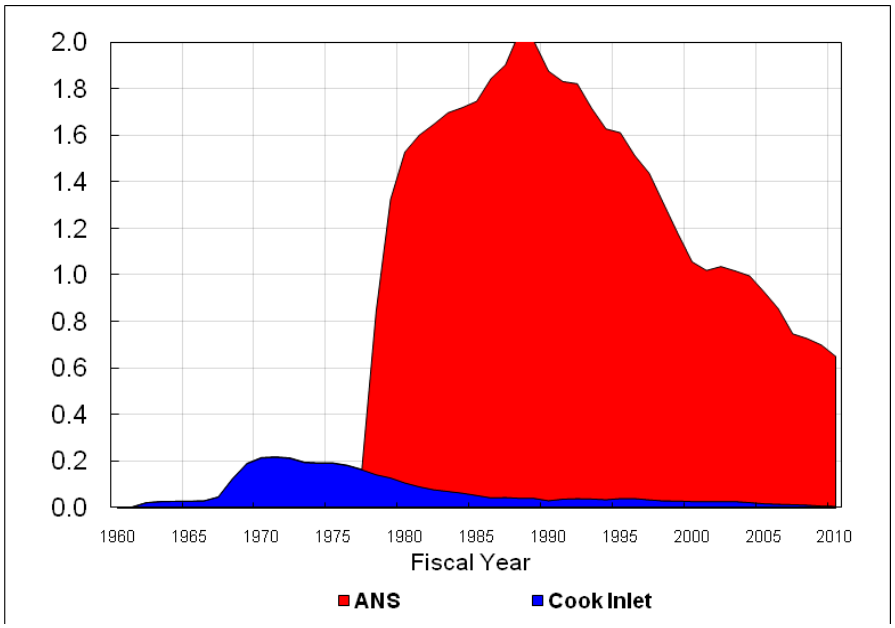
Like many small and remote islands, the import of public funds has been an important source of economic activity in Alaska. Figure 3 show that federal employment, both civilian and military, has historically been higher than employment in the traditional private basic sectors, and today remains on par with them. This figure underestimates the importance of federal dollars as it excludes any measure of the federal grants that flow into the state each year.

Figure 3 Employment in Federal Government in Alaska (000)



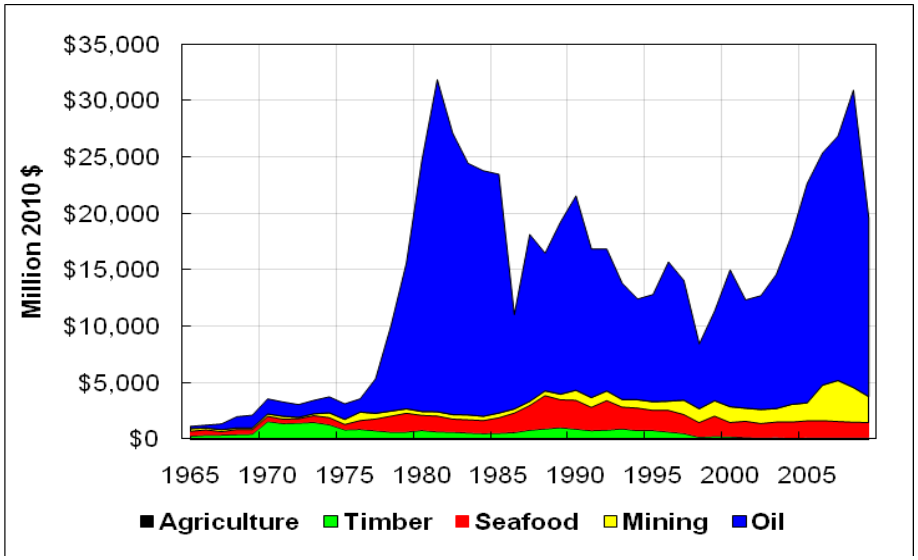
But there is one way in which Alaska is unlike virtually every small and remote island economy. Shortly after Alaska became a state the largest oil field in North America was discovered on the North Slope. Oil production began at Prudhoe Bay in 1977 and through 2010 about 17 billion barrels of oil have been produced from that field and others on the North Slope and Cook Inlet (discoveries and production began in Cook Inlet in the 1960s)

Figure 4 Alaska Oil Production (Million Barrels per Day)



The value of oil production has swamped that of all other natural resources combined.

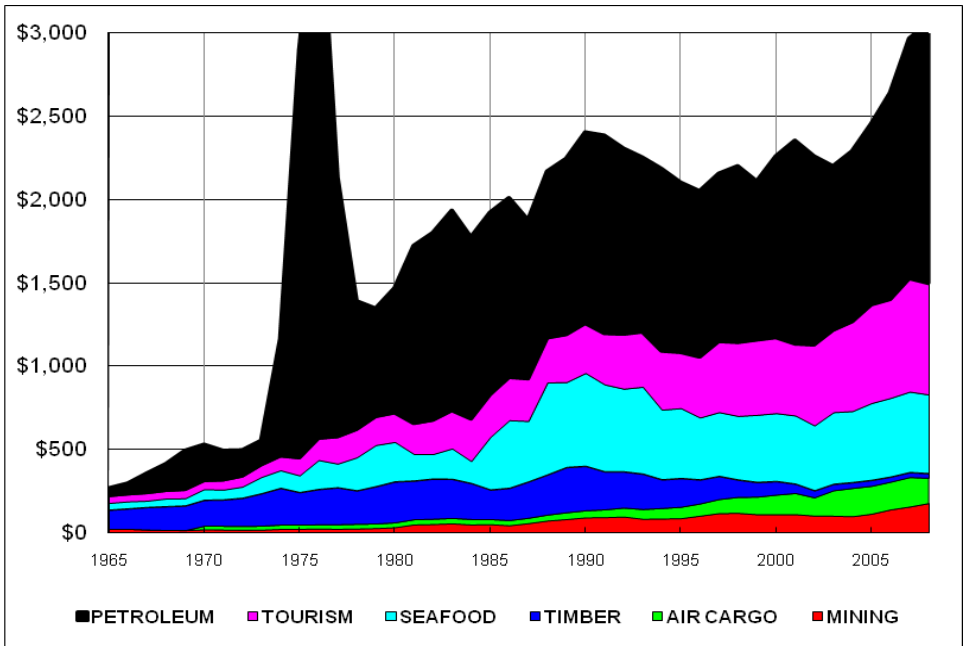
Figure 5 Alaska Gross Value of Resource Production (Million 2010 $)



The state has been able to capture a large share of the value added from production in two ways that have accounted for two thirds of the growth since Alaska became a state and have transformed the economy.

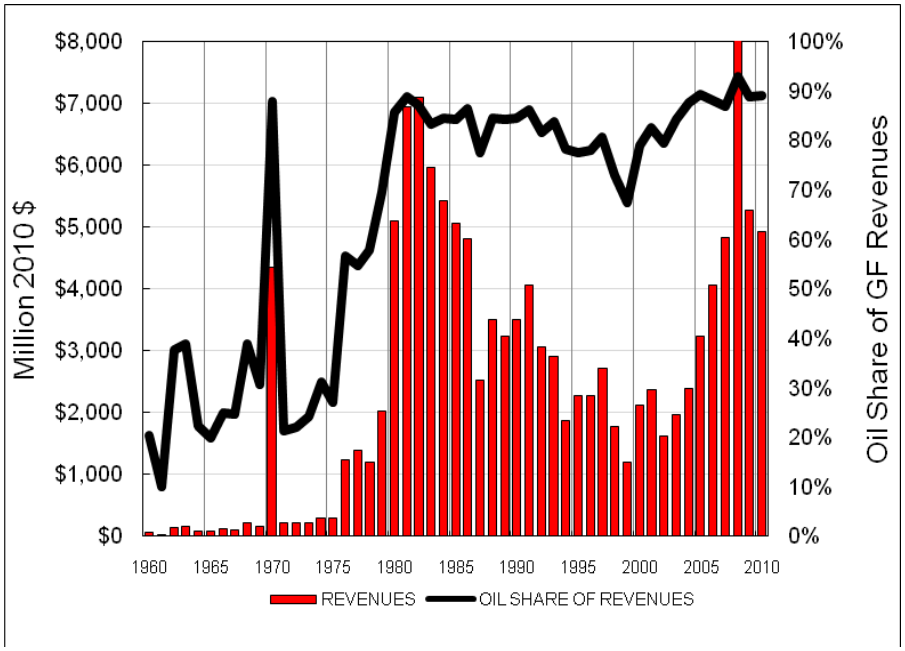
First, work in the oil patch has been a source of both payroll for Alaskan workers, and sales for Alaskan businesses providing services for exploration, development, and production activities.

Figure 6 Alaska Natural Resource Wages and Salaries (Million 2010 $)



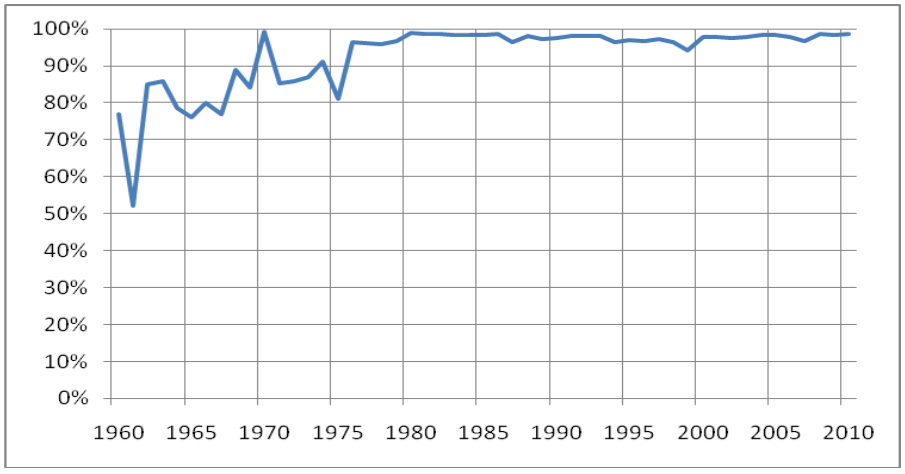
Second, Alaska has cumulatively collected $157 billion (2010 $) in oil revenues over the last 50 years. Oil has been the source of about 90 percent of state general fund revenues.

Figure 7 Alaska Oil Revenues and Their Share of State General Fund



Oil has accounted for virtually all state resource revenues.

Figure 8 Oil Share of State Natural Resource Revenues



Together spending on activity in the oil patch and the expenditure of state oil revenues today account for one third of all the jobs in the economy. But a number of spinoffs from oil activity have also contributed to expansion of the economy. Consequently today employment and personal income in Alaska are twice the size they would have been if the state economic base had only been its other natural resources

and federal government spending. The most important of these spinoffs are stability and wealth.

The jobs generated by activity in the oil patch and the jobs paid for with state oil revenues are year round, unlike those associated with either tourism or fishing. This creates an environment within which support businesses can grow and prosper. As a result the "economic multiplier" is larger than it otherwise would have been.

The oil revenues have reduced the tax burden on businesses and households and at the same time allowed state government to spend on public services at a level nearly twice the US average, measured by per capita spending. The lower tax burden on businesses has provided an environment for them to prosper and the public services have made also more attractive both for businesses and households. The rapid growth in the retiree population in the state is one consequence of that.

This oil driven rapid economic growth raises the question of whether the state has been stricken by the "resource curse". Although the oil wealth has led to some corruption and rent seeking behavior, it seems that the state has escaped one of the important symptoms which is a weakening of the rest of the export base. This would result from the bidding up of the price of labor as a result of the boom in the oil patch which would make the rest of the export base less competitive. However in an economy where migration of workers can equilibrate labor markets across regions, this is less likely to happen. Consequently the public expenditure benefits for the rest of the export base have probably more than offset any labor market related costs.

Has oil provided a way for Alaska to escape the island economy syndrome? That might be the case if oil production and revenues were sustainable looking forward. Unfortunately that is not the case. As Figure 4 shows, annual production peaked more than 20 years ago and is today only at one third of that level. Although the state forecasts a slowing of the decline rate for the next 10 years (Figure 9), if one pushes the projection out another decade, the decline accelerates significantly (Figure 10).

Figure 9 Alaska Department of Revenue Oil Production Forecast (Thousand Barrels per Day)

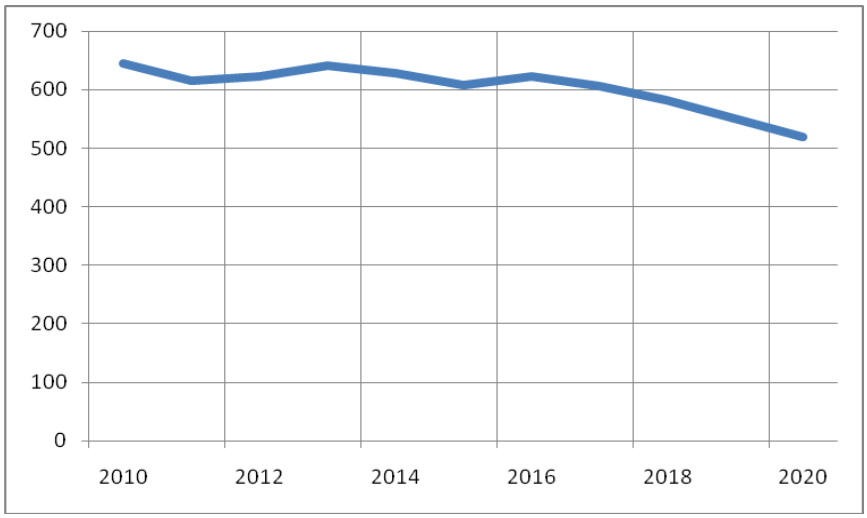
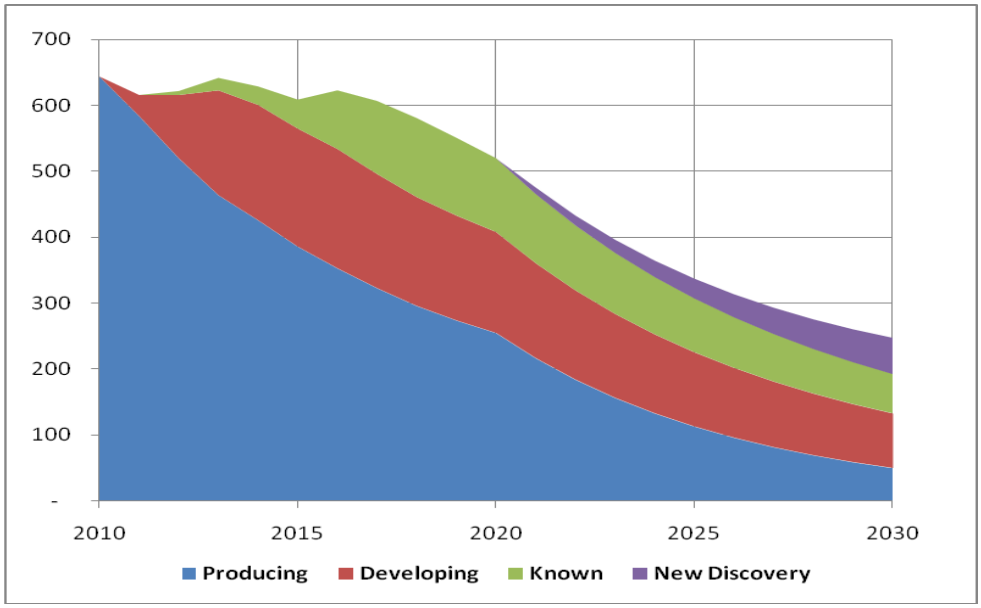


Figure 10 Oil Production Forecast: ADOR Extended (Thousand Barrels per Day)

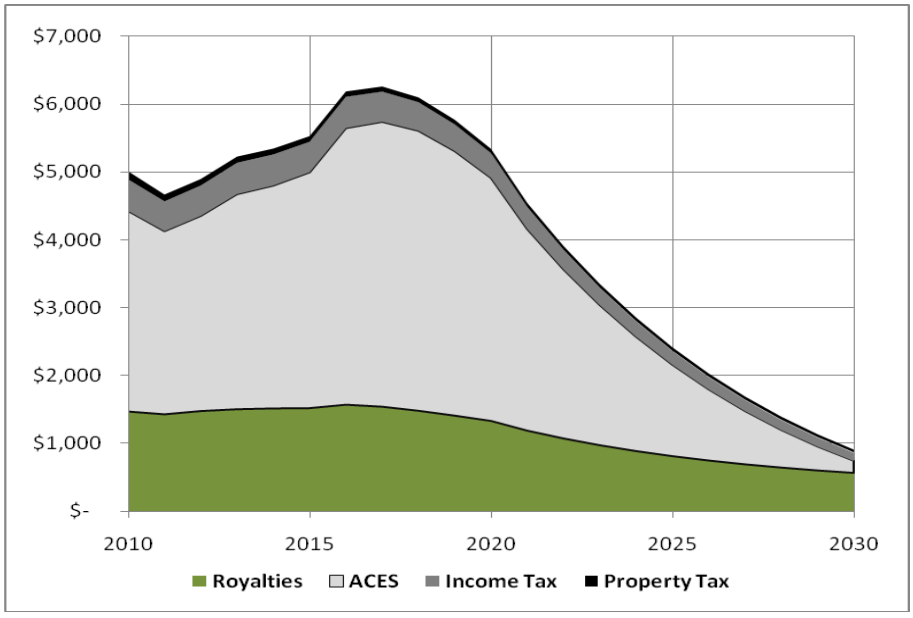


In has taken the state a long time to become concerned about the oil production decline for two reasons. First, during the last two decades total employment has continued to grow as production has fallen. This suggested that perhaps the economy was not as dependent on oil as some thought. Second, the high oil prices in the last decade have driven up oil revenues to unprecedented levels, and this has damped concerns about the need to think about the dependence of state government spending on the rate of oil production.

Now more attention is being directed at the question of what the prospects for the economy are because commercialization of North Slope natural gas looks less likely. Revenues from gas production could partially substitute for oil. And as North Slope production declines, the continued viability of the pipeline carrying that oil to market comes into question. A lower throughput means that oil moving through the pipeline is slower and colder. Both of those characteristics cause problems for operation of the pipeline so there is now more attention being given to the question of how to keep the flow rate through the pipeline as high as possible.

Future oil revenues depend on production and price, and again the outlook for the next 10 years appears to be good based on the Alaska Department of Revenue forecast, but beyond that the projected decline in production drives down revenues.

Figure 11 Projected Oil Revenues (Million 2010 $); Alaska Department of Revenue to 2020 and then Extended by the Author



If the industry that accounts for one in three jobs in the economy and has accounted for two thirds of the growth in the last 50 years is going into decline, what does the future hold for Alaska. Will the economy contract in a pattern that is the

reverse of the growth the state has enjoyed? Will that contraction lead to an outmigration population?

It is not inconceivable that the decline in petroleum could usher in a long term period of economic stagnation and population decline. Looking a decadal population change by state in the US since 1910, there have been several instances where population has not increased for a 20 year period. Many of these have been associated with migration out of the south and the great plains. However there have been at least three instances of more prolonged decline. The North Dakota population peaked at 681 thousand in 1930, fell to 620 in 1950 and had only increased to 673 by 2010. Arkansas was 1.949 million in 1940 and only 1.923 million thirty years later in 1970. West Virginia was 2.006 million in 1950 and only 1.853 million sixty years later in 2010.

Many people with limited understanding of the structure of the Alaska economy believe the economy can continue to grow independent of petroleum, but the economic history of the state suggests that the other export base sectors are too small to take up the slack that a declining petroleum industry would create. Others think that state government efforts to diversify the economy could work, even though there is no evidence of success after more than 50 years worth of efforts.

In 1978 Alaska created the Permanent Fund as a vehicle to both save a share of oil wealth in recognition that oil production was not sustainable, and to dampen the economic boom associated with the immediate expenditure of oil revenues when collected. More recently Alaska established the Constitutional Budget Reserve as a vehicle to save a portion of current petroleum revenues for use in times when revenues were low. Through a combination of good planning and good fortune the state has set aside $37 billion (2010 $) in these and other smaller financial savings accounts—24% of the $157 billion collected through 2010. With accumulated earnings the currently value in these accounts is about $45 billion. The savings in these accounts provides a vehicle for the state to offset the anticipated decline in production and revenues.

This oil wealth that has been converted into financial assets represents only a portion of the total oil wealth the state will receive from production of the resource. The state will also collect revenues from future production. The amount is impossible to know, but it makes sense to try to estimate this wealth still in the ground. Table 1 provides such an estimate of $81 billion based on what little information is available about the amount of oil (and gas) still in the ground, and the fiscal terms that will govern the state share of the total proceeds from the sale of production. This is the estimated net present value of future state petroleum revenues, discounted at a 5% real rate.

Table 1 Value for State Petroleum Wealth in the Ground in 2010 (Billion $

Total	$81	
Oil	$74	
State Land—North Slope 2011-2020	$45	Alaska Department of Revenue
State Land—North Slope 2021+	$27	Author estimate
State Land—Other Locations	-	
State Land—Heavy Oil	$1	Author estimate
Federal NPRA	-	Included in ADOR forecast
Federal OCS	$1	Author estimate
Federal ANWR	-	Author estimate
Gas	$7	TransCanada AGIA Application adjusted by author

In order to minimize the disruption due to the anticipated decline in economic activity associated with declining oil production and revenues, the state could convert its oil wealth—the financial assets and the oil in the ground which together sum to $126 billion—into an annuity. If it spent only the earnings thrown off by that annuity each year, it would last forever, and the amount spent would be constant so that it would have a stabilizing influence on the economy.

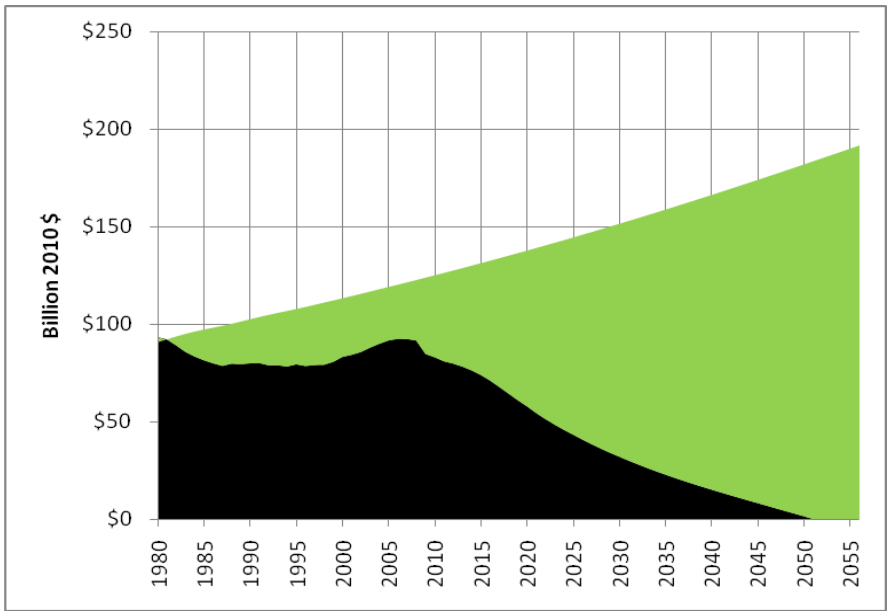
For example, if we believed that the oil wealth could earn a 5% rate of return, we could spend 5% of the value of oil wealth each year and still maintain its value. This

would be $6.3 billion, or $8,900 per person. If we believed the population of the state would grow at 1% annually, then we could only draw 4% each year--$5 billion, or $7,100 per person. Then the oil wealth would increase in value 1% each year to match the growth in population.tal NPV.

The amount we can spend does not depend upon how our oil wealth is held, that is how much is in the bank and how much is in the ground. Over time, as oil production continues, there will be a gradual transition from oil in the ground to financial assets, as shown in Figure 12. Here we see the value of the state oil wealth before production began was slightly less than $100 billion (2010), all in the form of oil in the ground. As the oil has been produced, a share of the revenues have been converted into financial assets, and each year the combined value of oil in the ground and financial assets has increased by 1% to account for population growth. Eventually, all the oil will have been produced and at that time the state will hold its oil wealth entirely as financial assets.

Each year the draw from assets would be $7,100 (2010) for each resident. There would be no restrictions on how that money was spent. It could be used to support public programs or distributed to individuals for private consumption.

Figure 12 Conversion of Oil Wealth from Oil in the Ground to Financial Assets



This strategy stabilizes the fluctuations from the spending of public revenues and distributes oil wealth equitably across current and future generations of Alaska residents. This is a reasonable policy if we care as much about future generations as we do about the present, and we expect future generations to be no richer or poorer than we are today. Although we might have some ideas about how rich the next generation will be, and recent evidence suggests they may be less well off than we are, economists cannot tell us how much we should care about the well being of future generations of Alaskans. If we care less about them, obviously we can spend more today, but of course they are not here today to make their case.

An oil wealth annuity might seem like a good idea in the abstract, but there are a number of practical challenges to implementation. First, the accumulation of so much money in a financial account might be politically difficult if not impossible to maintain. The temptation to spend would be intense and the discipline to hold the draw through good times and bad would be hard to maintain. Of course the state does have the Alaska Permanent Fund, which has a balance of $35 billion, so there is a precedent for such an account. Many argue that the Permanent Fund has been successfully maintained only because of the annual dividend check distributed to all Alaskans from the fund earnings.

Two popular arguments against holding a saving account aside from the philosophical one that the public should not hold wealth (Of course the public sector holds many types of assets.). One is that money in the bank does not generate any benefits.

The more relevant one is that the wealth should go into physical investments in infrastructure—transportation and energy are the ones most often suggested—to help to overcome ”remoteness”. These have two kinds of benefit--the short term benefit from the construction of these projects, and the longer term benefit from the services that they deliver for the economy.

If the annual flow from an oil wealth annuity would otherwise be stable, then putting more into construction spending would create a non sustainable boom. The value of the longer term services would be the wealth those services generated. Ideally a new road or dam would result in an increase in the export base or a reduction in the

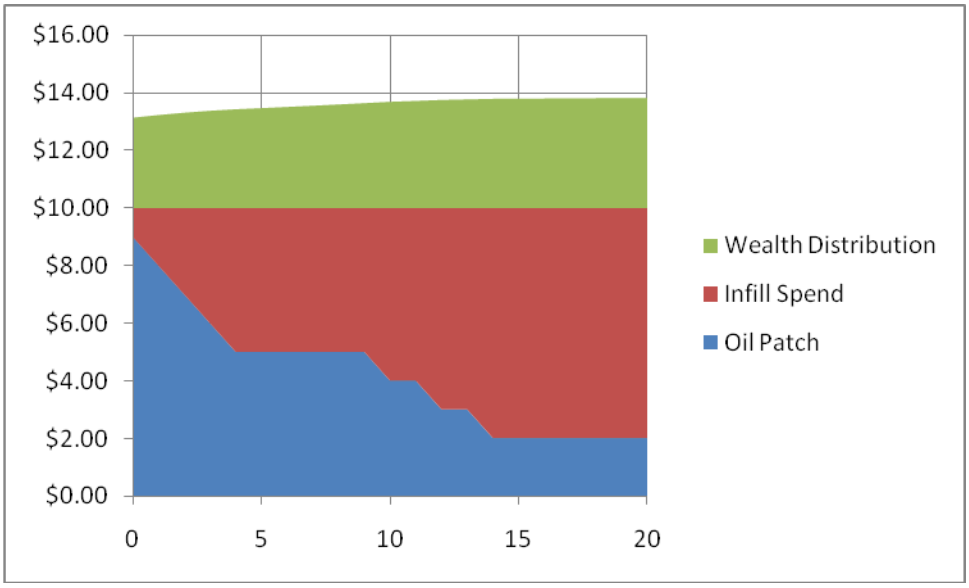
cost of goods and services for residents. The value of these would be the increase in wealth generated for residents. If the increase in wealth from that spending exceeds the growth if the money were alternatively reinvested, then those infrastructure projects should be undertaken.

Current state spending from oil wealth is roughly $5 billion. Based on our analysis the state could continue to spend from oil wealth at that rate for the foreseeable future. This spend rate would maintain the oil wealth of the state and forestall any economic decline associated with the need to cut back state spending as petroleum revenues declined in future years.

Although somewhat more than half the economic expansion from oil production has been the result of the spending of public revenues, we cannot ignore the boom associated with activity in the oil patch. If activity in the oil patch falls as production declines, the economy will contract in spite of a well designed oil wealth annuity as we have described it.

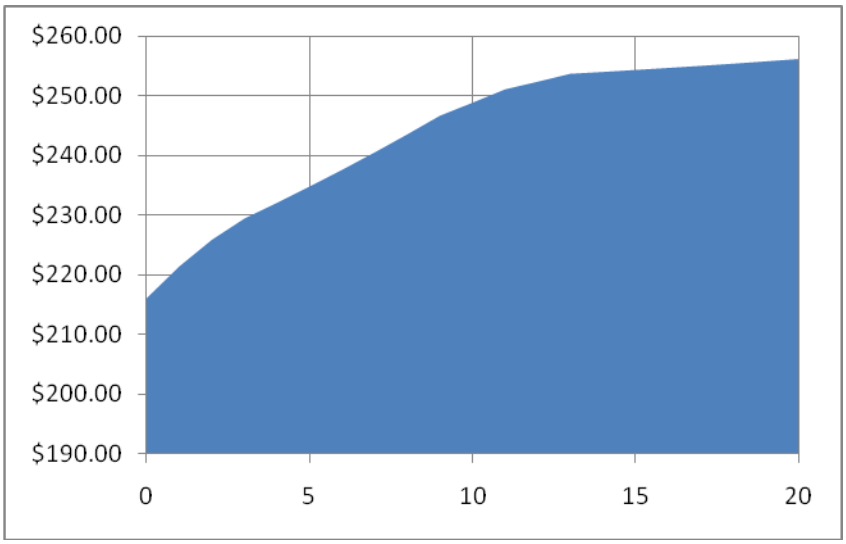
In Figure 13 we illustrate the challenge. Initially the economy is supported by oil patch spending that generates income of $9. Over time as oil production falls, oil patch spending also falls so the economic contribution of that activity declines until by year 15 it is only $2. An oil wealth annuity that pumps $3 into the economy each year (not growing with population) would smooth spending from petroleum revenues but not from oil patch spending. In order to smooth spending over time and eliminate the decline from the drop in oil patch employment, the spend from the oil wealth annuity would have grow as income from oil patch activity fell as reflected in the area labeled as “Infill spend”.

Figure 13 Maintaining Economic Stability with Decline in the Oil Patch



The math now gets a lot more complicated because the draw from oil wealth is no longer a fixed percentage. In addition, there are two important questions—what will the "infill spending" be spent on as a replacement for oil patch spending, and how can the discipline necessary to expand the size of the oil wealth account in the short run be maintained. Figure 14 shows the time path for the size of the fund consistent with the maintenance spending in Figure 13.

Figure 14 Oil Wealth Growth to Provide Offset for Oil Patch Decline



As it turns out, activity in the oil patch as measured by employment, has not declined over time with production as Figure 15 demonstrates. In spite of dramatic technological advances in the last 20 years, two factors seem to account for this pattern. First there is a large fixed cost component associated with production. And second as fields age they require increasing levels of maintenance and repair. Figure 16 shows this more dramatically as the decline over time in daily barrels of oil produced per employee.

Figure 15 Historical Comparison of Oil Production and Oil Patch Employment

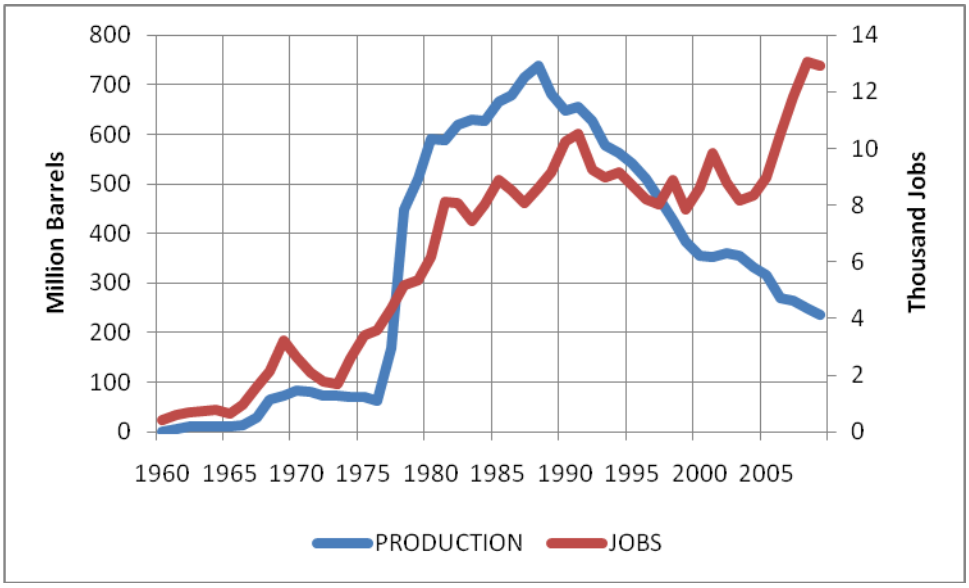
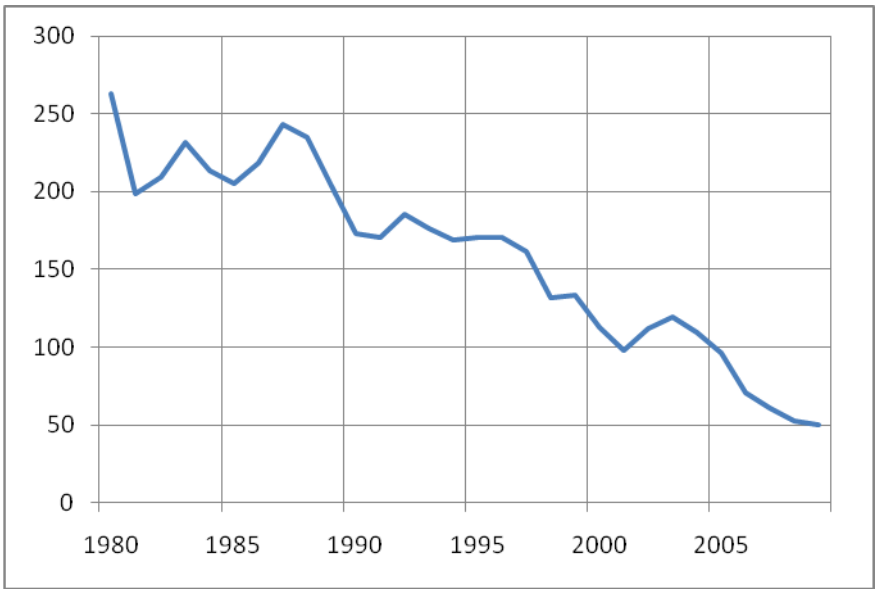
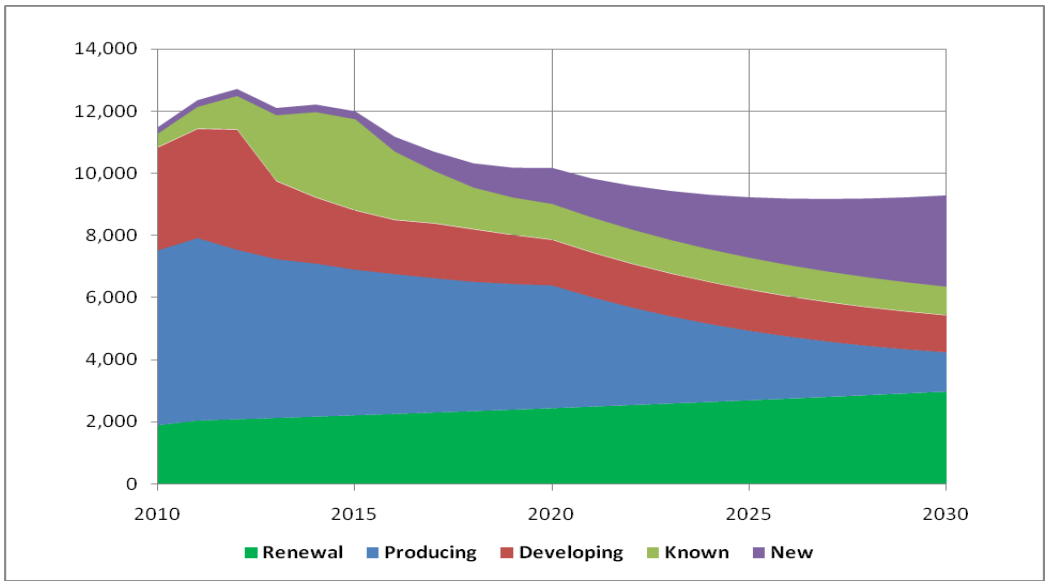


Figure 16 Barrels per Day per Employee



Looking forward, the prospects for stability in oil patch employment are good and the the possibility for expansion depends on possible developments in areas beyond those currently under production.—on federal lands onshore and offshore, and on the commercialization of gas, and technological advances that will make production of heavy oil or oil from shale attractive. For example one recent projection of employment in currently producing areas shows only a modest decline in employment over the next two decades.

Figure 17 Projection of Oil Patch Employment excluding Federal Lands



The Figure 18 Map shows the petroleum provinces on the North Slope. Most production to date has been on state lands onshore in the central North Slope. Bordering this province are the federal provinces—ANWR to the east and NPRA to the west. Two provinces of the outer continental shelf in federal waters are the Chukchi and the Beaufort Seas. The combined oil resources in these provinces is currently estimated to be about 70 billion barrels (Table 2), but this is only a guess and does not factor in how much might be technically or economically recoverable. (By comparison about 17 billion barrels have been produced from Alaska in the last 50 years.) Nonetheless the extraction of only a small part of this resource would generate a large number of jobs in the future, although only modest revenues for the state. Table 3 shows in detail how state revenues fall as production moves to federal land or federal offshore provinces.

Figure 18 Oil and Gas Provinces on North Slope of Alaska

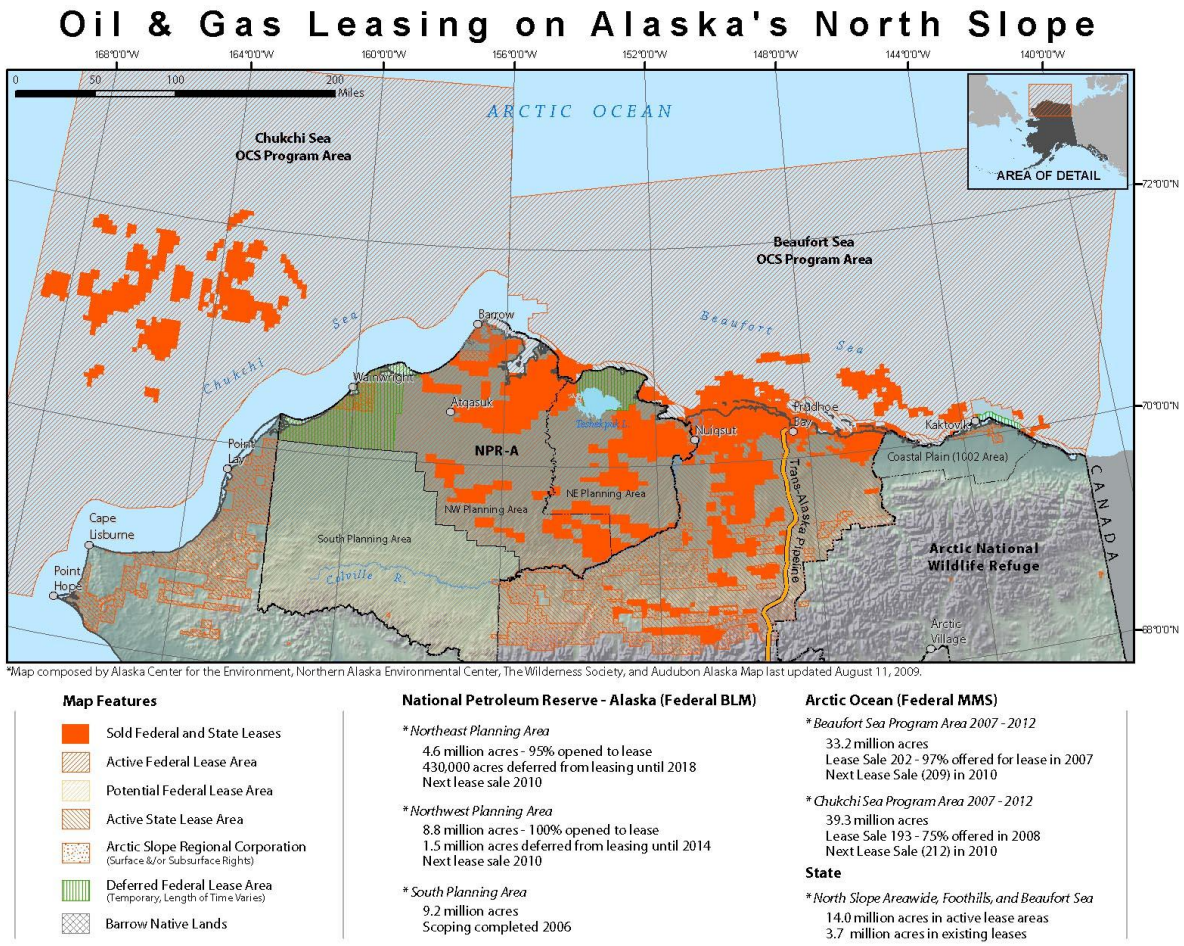


Table 2 Estimated Remaining North Slope Oil Resources

Location	Billion Barrels of Oil
TOTAL	
State	
Producing Fields	5
Yet to be Discovered	2
Heavy Oil	30
Federal Onshore	
NPRA	1
ANWR	10
Federal Offshore OCS	
Beaufort Sea	
Chukchi Sea	

Table 3 State Fiscal Terms for Oil Production on Lands under Different Ownership

	ONSHORE TO 3 MILES OFFSHORE[12]							OFFSHORE	
	STATE				FEDERAL[13]		PRIVATE	FEDERAL	
	North Slope		Cook Inlet						
	Lease <1980	Lease >1980	Lease <1980	Lease >1980	NPRA	ANWR		3-6 Miles	More Than 6 Miles[14]
ACES Production Tax	Yes	Yes	ELF[15]	ELF	Yes	Yes	Yes	No	No
Corporate Income Tax	Yes	Yes	Yes	Yes	Yes	Yes	Yes	?[16]	?
Property Tax[17],	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No[18]	No
State Royalty[19],	Typically 12.5% of value	Typically 12.5% of value	Typically 12.5% of value	Typically 12.5% of value	-	-	--	-	-
Federal Royalty	-	-	-	-	Typically 12.5% of value	Typically 12.5% of value	-	Typically 12.5% of value	Typically 12.5% of value
State Share of Federal Royalty[20],[21]					[22]	50%		27%	0%
Royalty—PF Share[23]	25%	50%	25%	50%	25%	25%	-	25%	-
Royalty—GF Share	75%	50%	75%	50%	75%	75%	-	75%	-

[12] The state owns the continental shelf up to 3 miles offshore.

[13] Both NPRA and ANWR have private (Native) in holdings.

[14] Although Alaska shares no federal royalties beyond 6 miles under current law, the Gulf states receive 37.5 % of federal royalties until 2017. After that they share royalties only on properties leased after 2006.

[15] Cook Inlet production can still pay taxes at the rate under the old production tax based on the economic limit factor (ELF).

[16] Aggregate state corporate income tax revenues would change from production in the OCS since the formula for producers to allocate worldwide income includes property, sales, and production. OCS reduces the state allocation but increases total worldwide income. In some circumstances the total liability of a producer would increase while in other it would decrease.

[17] The state property tax is shared with local government jurisdictions within which the petroleum property is located.

[18] It is likely that some OCS related infrastructure would be on shore and thus taxable by the state.

[19] A royalty is a contract negotiated between the owner and developer of the petroleum. Although 12.5 % of wellhead value is typical, many fields have different rates or methods for determining the payment, like net profit sharing.

[20] The statehood act specified 90 percent state sharing of federal royalties, but this has been modified by law for NPRA and ANWR.

[21] Federal bonuses are shared with the state based on the same formula as royalties.

[22] Based on federal law, the state must share NPRA royalties with locally impacted communities, and in the past has retained no revenues. The vehicle for sharing is the NPRA Special Revenue Fund.

[23] The Permanent Fund contribution from shared federal royalties is governed by a different statute than state royalties

Dependence on non renewable resource extraction

How can the regional economy benefit from this temporary activity

Look at a simple model

The time pattern of extraction looks like this